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NATIONAL SENIOR CERTIFICATE

GRADE 12

SEPTEMBER 2025

CIVIL TECHNOLOGY: CONSTRUCTION MARKING GUIDELINE

MARKS: 200

This paper consists of 13 pages including 2 answer sheets.



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Proudly South African

QUESTION 1: SAFETY AND MATERIAL (GENERIC)

- 1.1 1.1.1 760 mm x 560 mm (1)
- 1.1.2 3,7 m (1)
- 1.1.3 30° (1)
- 1.1.4 50° (1)
- 1.1.5 510 mm (1)
- 1.2 ANY **TWO** MATERIALS THAT LADDERS ARE GENERALLY MADE OF.
- Wood
 - Aluminium
 - Fibreglass (2 x 1) (2)
- 1.3 - Lifting medium (2 x 1) (2)
- Power type
- 1.4 Water-based – provides an elastic, flexible finish (1).
Oil-base – provides a hard, durable finish (1). (2 x 1) (2)
- 1.5 ANY **THREE** PROPERTIES OF THE CURING PROCESS OF CONCRETE.
- Surface of cured concrete is durable.
 - Improves the protection of the steel reinforcement.
 - Curing allows concrete to achieve optimal strength and hardness.
 - Avoids cracking where the surface dries out quickly.
 - Improves abrasion resistance. (3 x 1) (3)
- 1.6 **THREE** ADVANTAGES OF ELECTROPLATING.
- Protects metal against corrosion.
 - Improves the engineering and mechanical properties of metal.
 - May also be used to increase the thickness of undersized parts. (3 x 1) (3)
- 1.7 Process of applying a plastic finish/coating in powder form (1), using a compressed air spray-gun (1). (2)
- 1.8 Zinc (1)
- [20]**

QUESTION 2: GRAPHICS, JOINING AND EQUIPMENT

- 2.1 Answers on ANSWER SHEET A. (20)
- 2.2 2.2.1 A – Laser level
B – Telescopic staff
C – Tripod (3)
- 2.2.2 ANY **TWO** BELOW:
- Place the laser level in its case directly after use
 - Do not bump the instruments against objects or drop it
 - It must be properly calibrated
 - It must be handled carefully (2 x 1) (2)
- 2.3 2.3.1 The reading on the staff is 1,5 m (1)
- 2.3.2 Minimum = 30 m
Maximum = 200 m (2)
- 2.4 2.4.1 Use a dry, soft cloth, not a cleaning agent or solvent. (1)
- 2.4.2 Remove batteries (1)
- 2.5 **A** Nut with built-in washer (1)
- B** Wing nut (1)
- C** Domed nut (1)
- 2.6 2.6.1 Rawl bolt (1)
- 2.6.2 **A** – Drill a hole to the required diameter and depth. (1)
- B** – Remove debris and clean the hole thoroughly with a brush or by blowing it. (1)
- C** – Remove the bolt and washer, insert the shield and place the fixture over the hole. (1)
- D** – Insert the bolt with washer through the fixture and tighten to the recommended torque. (1)
- 2.6.3 ANY **TWO** BELOW:
- It is a strong fastener that resist pull-out failure.
 - Rawl bolts have excellent carrying capacity and tolerance to a variance in the hole size.
 - Excellent mechanical properties, such as tensile strength and yield stress. (2 x 1) (2)

[40]

QUESTION 3: ROOFS, STAIRCASES AND JOINING**3.1 ANY THREE TYPES OF ROOF TRUSSES:**

- South African roof truss
- Single Howe truss
- Couple roof
- Closed couple roof
- Collar-tie roof
- King post roof truss
- W-truss or Fink truss
- Fan truss
- Scissors truss

(Any 3 x 1) (3)

3.2 ANY THREE ADVANTAGES OF THE USE OF ROOF UNDERLAYS:

- Acts as a secondary roof
- A weather shield during construction
- Waterproof and weatherproof
- Condensation barrier
- Dustproof
- Protects the building / structure
- Protects thermal insulation material
- Protects ceiling boards
- Superior wind uplifting strength prevents lifting of tiles
- Vapour resistant
- High tensile resistance
- Cost effective
- High heat resistance

(Any 3 x 1) (3)

3.3 3.3.1 **A** – Ridge tile (1)**B** – Clay tile (1)**C** – Batten (1)**D** – Waterproof underlay / DPC (1)**E** – Rafter (1)

3.3.2 38 mm (1) x 114 mm (1) (2)

3.3.3 Allows rainwater that is blown in under the tiles to flow to the gutters. (1)

3.4 3.4.1 Run (1)

3.4.2 Landing (1)

3.4.3 Tread/going (1)

- 3.5 **A** – Handrail (1)
- B** – Baluster (1)
- C** – Riser (1)
- 3.6 750 mm (1)
- 3.7 38° (1)
- 3.8 3.8.1 True (1)
- 3.8.2 False (1)
- 3.8.3 True (1)
- 3.9 3.9.1 Roof truss and brick wall are fixed to each other. (1)
- 3.9.2 **A** – Galvanised steel strap/hoop iron strap. (1)
- B** – Wall plate (1)
- 3.9.3 600 mm (1)
- 3.9.4 Nailed/Bolted (1)
- [30]**

QUESTION 4: MATERIAL, EXCAVATIONS, EQUIPMENT AND TOOLS

- 4.1 4.1.1 F (tested on site) (1)
- 4.1.2 G (high volume of concrete) (1)
- 4.1.3 E (ferrous metals) (1)
- 4.1.4 C (tested in a laboratory) (1)
- 4.1.5 A (small volume of concrete) (1)
- 4.1.6 B (non-ferrous metals) (1)

4.2 ANY FOUR TYPES OF APPARATUS FOR THE SLUMP TEST:

- Slump test cone/mould
 - Base plate
 - Tamping rod
 - Ruler/Tape measure
 - Spirit level/Rod
- (Any 4 x 1) (4)

4.3 ANY TWO – DISCUSS THE PURPOSES OF THE CUBE TEST:

- Determine the maximum compressive strength of cured concrete with load.
 - Ensure concrete complies with requirements of project specifications.
 - Indicate compressive strength in MPa, thus the its ability to resist loads.
- (Any 2 x 1) (2)

4.4 DRAW A NEAT SKETCH OF A NORMAL FAILURE OF A CUBE TEST:

(Any 3 x 1) (3)

4.5 ANY THREE – DISCUSS THE PURPOSES OF CLADDING TO EXTERNAL SURFACES OF BUILDINGS:

- Aesthetic purposes
 - Functional purposes
 - Help to control weather elements (rain/wind)
 - Prevent runoff (water) from penetrating the building
- (Any 3 x 1) (3)

4.6 ANY TWO METHODS OF FIXING CLADDING:

- Adhesive fixing
 - Face fixing
 - Proprietary fixing
- (Any 2 x 1) (2)

- 4.7 **ANY THREE SAFETY FACTORS AND REGULATIONS THAT A SITE MANAGER MUST HAVE IN PLACE, BEFORE EXCAVATION COMMENCES:**
- Ensure a competent person evaluates the stability of the ground
 - Draw safety plan and take steps to ensure safe working conditions
 - Ensure that planned excavations/trenches be supported by a protective system (formwork/shoring) and be indicated on safety plan
 - Eliminate as many risks and hazards as possible
 - Erect fencing (at least one metre high) around perimeter of excavations
 - All excavations done under qualified supervision
 - Carry out of inspections to determine position of services (cables, pipes)
- (Any 3 x 1) (3)
- 4.8 4.8.1 Fencing/Warning signs/Warning lights/Covering (1)
- 4.8.2 All workers must wear protective clothing (1)
- 4.8.3 With a ladder/scaffolding (1)
- 4.8.4 Inspections must be done daily (1)
- 4.9 4.9.1 True (1)
- 4.9.2 True (1)
- 4.9.3 False (1)
- 4.9.4 False (1)
- 4.10 4.10.1 Firm ground/Hard ground (1)
- 4.10.2 **A** – Poling boards (1)
- B** – Strut (1)
- C** – Walling boards (1)
- D** – Folding wedges (1)
- 4.11 4.11.1 Plate compactor (1)
- 4.11.2 **ANY THREE WAYS TO CARE AND MAINTAIN THE PLATE COMPACTOR:**
- Maintain – lubricate and adjust to manufacturer's instructions
 - Clean after use and store in a safe, dry place
 - Repair/replace damaged electrical cords
 - Service regularly
 - Remove loose dirt and soil after use
 - Ensure that all parts are firmly attached
- (3 x 1) (3)

[40]

QUESTION 5: BRICKWORK, GRAPHICS, PLASTER AND SCREED

- 5.1 5.1.1 Half brick wall/Internal wall (1)
- 5.1.2 110 mm (1)
- 5.1.3 2,4 m (1)
- 5.2 **ANY THREE ADVANTAGES OF CAVITY WALLS:**
- Prevent rainwater from penetrating the interior wall surface
 - Provide good thermal and sound insulation
 - Cheaper materials can be used for internal walls
 - Reduces / prevent expensive exterior finishes (Any 3 x 1) (3)
- 5.3 5.3.1 50 mm (1)
- 5.3.2 8 m (1)
- 5.3.3 To remove wasted mortar (1)
- 5.3.4 Wall ties (1)
- 5.3.5 Allows water that penetrates the outside wall to drain. (1)
- 5.4 Double triangular pattern (1)
- 5.5 5.5.1 **A** – Gutter (1)
- B** – Fascia board (1)
- C** – Ceiling board (1)
- 5.5.2 Closed eave construction. (1)
- 5.6 5.6.1 F (prepared layer beneath paving and bedding sand) (1)
- 5.6.2 C (best edge restraint for paving) (1)
- 5.6.3 A (natural soil on which the paving will be laid) (1)
- 5.6.4 D (final layer upon which paving is laid) (1)

5.7 **ANY TWO ADVANTAGES OF MORTAR-SET PAVING:**

- Little maintenance is required
- Low life-cycle cost
- Resistant to point loads
- Resistant to fatigue and reflecting traffic patterns
- Resistant to edge movement
- User-friendly installation material is used
- No weeds will be able to grow in between the joints
- No off-gassing installation products used
- Insects will not be able to ruin the appearance of the paved structure

Any (2 x 1) (2)

5.8 **ANY TWO REASONS FOR CONSTRUCTION FAILURE OF PAVING:**

- Concrete haunch too thin to support itself and cracks or crumbles under pressure
- Too little weight to retain the structure and keep paving in place
- Bond between haunch and edge units is weak and will easily crumble
- Subbase is not contained and will be washed out by groundwater

(Any 2 x 1) (2)

5.9 5.9.1 Segmental gauged arch (1)

5.9.2 **A** – Key brick (1)**B** – Skewback (1)**C** – Extrados (1)5.10 **ANY TWO TYPES OF SCREED:**

- Dry screed
- Monolithic screed
- Bonded screed

(Any 2 x 1) (2)

[30]

QUESTION 6: FORMWORK, REINFORCEMENT, FOUNDATIONS, CONCRETE FLOORS AND QUANTITIES (SPECIFIC)

6.1 ANY ONE MATERIAL THAT CAN BE USED TO LINE THE FORMWORK, TO OBTAIN A SMOOTHER FINISH:

- Plastic
- Metal sheeting
- Hardboard
- Fibre-glass

(Any 1 x 1) (1)

6.2 6.2.1 A – Bearer/head tree

(1)

B – Brace/strut

(1)

C – Prop/strut

(1)

D – Soleplate

(1)

6.3 6.3.1 Soft/mild steel

(1)

6.3.2 200 mm

(1)

6.3.3 10 mm diameter

(1)

6.4 6.4.1 Compressive forces (Anchor bars)

(1)

6.4.2 Shear forces (Stirrups)

(1)

6.5 ANY ONE METHOD OF JOINING STEEL BARS WITH WIRE:

- Crosswise method
- Hair knot method
- Crown method

(Any 1 x 1) (1)

6.6 ANY TWO PURPOSES OF THE COVER DEPTH AT THE REINFORCING OF CONCRETE WORK:

- To protect steel against corrosion
- To ensure adequate bonding between the steel and concrete
- To ensure adequate protection of steel in event of a fire

(Any 2 x 1) (2)

6.7 ANY TWO TYPES OF PILE FOUNDATIONS:

- Precast concrete piles/prefabricated piles
- Steel tube caisson piles
- In-situ (driven) foundation piles
- Short-bored (auger) piles

(Any 2 x 1) (2)

6.8 ANY THREE REASONS FOR USING PILE FOUNDATIONS:

- Ground conditions not stable/solid enough
- Distribute the load to more stable ground (underground/water supports)
- Provides stability when raft/floating foundation is used
- When structures are subjected to horizontal forces, resist pile foundations bending stress while still lending vertical support
- Soils prone to swelling and shrinking (clay soil)
- Superstructure is exposed to uplifting forces (offshore platforms)
- Where soil erosion is possible (bridges) (Any 3 x 1) (3)

6.9 6.9.1 **A** – Hollow-core blocks/Concrete floor block. (1)

B – Rib/Reinforced ribs/Pre-stressed ribs. (1)

6.9.2 **ANY ONE DISADVANTAGE OF THE RIB-AND-BLOCK FLOOR CONSTRUCTION:**

- Mechanical handling for the ribs requires on site
- Manual labour required to place blocks between ribs (Any 1 x 1) (1)

6.10 6.10.1 Answers on ANSWER SHEET B. (5)

6.10.2 Answers on ANSWER SHEET B. (4)

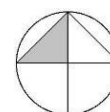
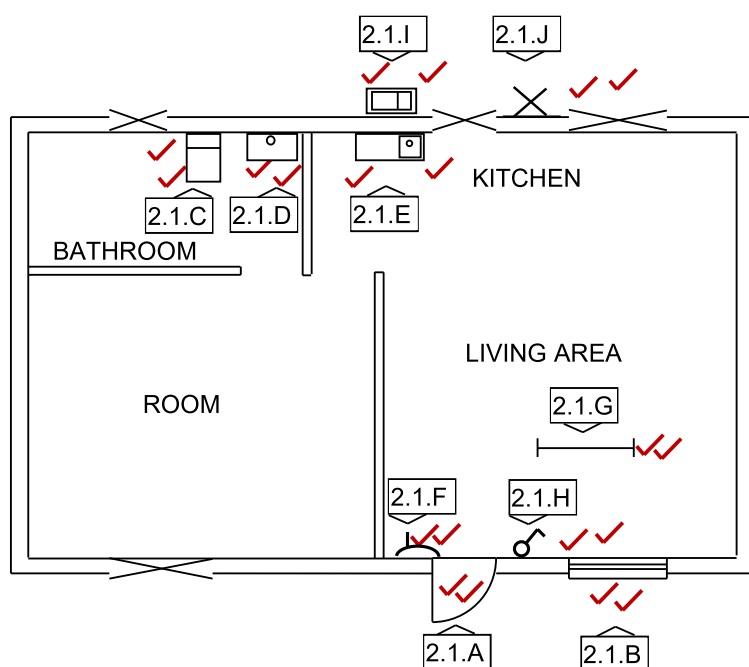
6.11 6.11.1 Answers on ANSWER SHEET B. (5)

6.11.2 Answers on ANSWER SHEET B. (5)

[40]**TOTAL: 200**

ANSWER SHEET	A	CIVIL TECHNOLOGY (GENERIC)	NAME AND	
			SURNAME:	

- 2.1 Use the information on ANSWER SHEET A and complete the floor plan on scale 1 : 100. (20)



Outside door at 2.1.A	2	
Window at 2.1.B	2	
Water closet at 2.1.C	2	
Wash basin at 2.1.D	2	
Single sink unit at 2.1.E	2	
One-way switch – single pole at 2.1.F	2	
Fluorescent light at 2.1.G	2	
Socket outlet at 2.1.H	2	
Grease trap at 2.1.I	2	
Wall-mounted light at 2.1.J	2	
TOTAL	20	

ANSWER SHEET			B	CIVIL TECHNOLOGY (SPECIFIC)	NAME AND SURNAME:			
A	B	C	D		A	B	C	D
6.10.1					6.11.1			
Calculate the centre-line of the external walls.					Calculate the volume of the concrete needed for the concrete footing.			
			8 000 x 2 = 16 000 mm ✓ 5 000 x 2 = <u>10 000 mm</u> ✓ = 26 000 mm ✓ -4 x 270 = <u>-1 080 mm</u> ✓ = 24 920 mm ✓ = 24.92 m		1/ ✓	31.50 ✓ 0.35 ✓ <u>0.65</u> ✓	<u>7.17</u> m³ ✓	
(5)					(5)			
6.10.2					6.11.2			
Calculate the quantity of bricks needed for the external walls of the building if the walls are 2.4 m high.					Calculate how many bags of cement will be needed for the concrete footing.			
2/ ✓	50 ✓ <u>24.92</u>	<u>2492</u> ✓	Bricks ✓		$\frac{1}{9}$ / ✓	7.17 ✓	0.80	m³ ✓ $\frac{0.80}{0.03} = 26.6$ ✓ = 27 Bags of cement
(4)					(5)			
PAGE 1					PAGE 2			